Livestock Science 121 (2009) 219–226

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Effects of breed type and supplementation during grazing on carcass traits and meat quality of bulls fattened on improved savannah

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ARTICLE INFO

Article history:
Received 13 August 2007
Received in revised form 26 April 2008
Accepted 17 June 2008

Keywords:
Breed type
Beef cattle
Carcass
Brahman
Bulls
Supplementation

ABSTRACT

Seventy-one bulls representing six breed types: Brahman (BR), F1-Romosinuano (F1ROMO), F1-Limousin (F1LIMO), F1-Angus (F1ANG), F1-Gelbvieh (F1GELB) and ¾ *Bos taurus* (BT) were used to study the effect of breed type and supplementation on carcass traits and meat quality. Slaughter weight endpoint was at approximately 500 kg. In the non-supplemented group, carcasses of F1ANG and BR surpassed the 56% dressing value, whereas those from F1ROMO, F1LIMO and BT dressed less than 56%. However, F1ROMO and BT groups improved their carcass dressing in two percentage points approximately ($P<0.05$), with supplementation. Carcass weight was only affected by supplementation treatments ($P<0.05$). At slaughter, the supplemented group dressed higher (56.1%) and produced heavier, less mature, better shaped carcasses than the control group. F1 GELB and F1LIMO showed larger (>68 cm^2) *longissimus* muscle area (LMA) whereas F1ANG and BR carcasses had better external fat finishing scores and thicker 12th-rib fat thickness (<1.3 mm). Breed types significantly differed in the yield of most-valuable boneless cuts. Carcasses from supplemented bulls yielded 0.8% more trimmed fat and 1.5% less total retail product.

The supplementation × breed type interaction was significant for Warner–Bratzler shear force (WBSF) and overall tenderness. Steaks from BR, F1GELB and BT resulted with higher WBSF values and lower scores for overall tenderness when animals were supplemented ($P<0.05$) whereas the highest tenderness score and lowest WBSF value were obtained by non-supplemented BT bulls. The small differences found between BR and crossbred types allows for describing a similar carcass/beef quality performance under the present grazing conditions. Supplementation on pasture, as designed herein, proved to be a useful practice to improve carcass dressing and overall carcass finish but had detrimental effects on bull meat quality. Other management strategies such as castration, and (or) implants, combined with alternate fattening regimes on tropical savannahs, must be designed to improve meat quality of Zebu-influenced bulls.

1. Introduction

In Venezuela, most of the cow-calf operations are located on large extensions of savannahs and natural grasslands, which are seasonally flooded and where the beef production performances of native and zebu cattle are generally low (Plasse et al., 1992). However, many beef cattle producers have shown a growing interest to improve these ecosystems by introducing and/or upgrading some pasture managing practices such as: cultivation of tropical grasses of higher nutritional value and pasture fertilization. Also, genetic technologies are available to increase yield and some ranchers have implemented cross-breeding programs to diversify the traditional Zebu cow-calf production system by raising and fattening F1 young bulls (slaughtered at less than 30 months). This type of management plan requires on-pasture, strategic supplementation during the dry season to enhance fermentative rate and efficiency to allow higher dry matter intake and animal productivity (Byers et al., 1997) in a short period of time.

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doi:10.1016/j.livsci.2008.06.015

Breed differences in production traits are important genetic resources for improving beef production efficiency, and meat composition and quality. Evaluation of beef carcass traits and meat palatability from different breeds or breed crosses allow determining the potential value of alternative genetic resources for beef production. Crossbreeding is broadly used to generate heterosis among breeds that is generally reflected as an improvement of the efficiency in meat production (Crouse et al., 1989). The economic value of *Bos indicus* livestock, particularly Brahman, in crossbreeding programs, is well known. The Brahman breed prevails in the Venezuelan production systems due to its adaptability to tropic conditions and its excellent maternal ability. However, with recent incorporation of exotic breeds like Continental and British *Bos taurus* types, in crossbreeding programs for beef production, the characterization of these crossbreed in their meat yield and quality traits under tropical ranching conditions is strongly needed.

The objective of this study was to determine the effect of breed type and strategic supplementation on carcass traits, cutting yield and meat quality derived from young bulls fattened on semi-intensively improved savannah.

2. Materials and methods

The experiment was carried out in a ranch operation located at Apure State (7 °54′North of the equator and 43 m above sea level). Annual precipitation (May–October) ranges from 1000–1800 mm with temperature of 22–29 °C. This trial was part of a large set of experiments designed to compare top-crossing of Brahman cows to different *Bos Taurus* breeds under tropical conditions. The choice of semen from *Bos Taurus* breeds tried to sample as many bulls as possible to represent the gene pool of the corresponding breed, and to replicate same bulls with progeny in different herds. A total of 71 bull calves of the following breed types: Purebred Brahman (BR), F1 Gelvieh (F1GELB), F1 Romosinuano (F1ROMO), F1 Limousin (F1LIMO), F1 Angus (F1ANG) and ¾ *Bos taurus* (BT) were used. The BT group came from a mating of different purebred *Bos taurus* sires with F1 Brahman cows (made of several *Bos taurus* breeds). Purebred Brahman was produced with bull semen selected for growth by genetic test programs carried out in several Venezuelan ranches. Traits emphasized in selection were mainly growth; with best linear unbiased prediction (BLUP) values being predicted for: birth weight (direct and maternal), weaning weight adjusted to 205 days of age (direct and maternal) and post weaning weight adjusted to 548 days of age (Plasse et al., 2002). Growth traits were analyzed using multiple-trait models to account for genetic correlations between traits (Plasse et al., 2002). *Bos taurus* sires were selected mainly for growth traits, including direct and maternal effects. Calves remained with their mothers during the pre-weaning stage, in natural good-quality grasses and free access to minerals. All animals were treated against ecto- and endo parasites and vaccinated against foot-and-mouth disease before entering to the finishing phase. Animals were rotated among pastures for a period of 32 days (4 days of occupation and 28 days of rest). At the beginning of the finishing period, six animals from each breed type were randomly assigned to one of the supplementation treatments.

Animals included in the supplementation group received a ration of 1.0% of live weight, with an average offer of 4.5 kg/day/animal during the trial. The expected average daily weight gain was 1.2 kg/day, and the ration was adjusted according to their nutritional requirements and the nutrient contributions estimated for the forage (Table 1). Supplementation consisted of 40.9% poultry litter, 50% rice polishing, 6% molasses, 1.5% salt, 1.5% minerals and 0.083% Rumensin®. All cattle were individually weighed initially and at 30-day intervals until they reached approximately 500 kg. Animals averaged 352 kg at the beginning of the supplementation trial.

The fattened bulls were transported to a commercial slaughterhouse located approximately at 500 km away from the ranch. Animals were marketed in groups as they reached the slaughter end point. Slaughter procedures and *postmortem* inspection of the carcasses were carried out according to the regulation 435-82 of the Venezuelan Commission for Industrial Standards (COVENIN, 1982a). The pelvic, kidney and heart fat of each carcass was not removed. Carcass conformation grade (based on a five-point muscling score: 1 = very convex, 2 = convex, 3 = rectilinear, 4 = concave, 5 = very concave), external fat finishing score (1 = extremely abundant, 2 = abundant, 3 = medium 4 = slight, 5 = scarce.) were evaluated according to the Venezuelan carcass grading procedure (Venezuela, 1994). After carcasses were chilled for 48 h, cross-sectional areas for *longissimus* muscle at rib interfaces were measured with a plastic grid (LMA, cm^2). 12th-rib fat thickness (mm) was measured with a metal probe. Marbling amount, lean color and texture (lean maturity), and skeletal maturity scores were determined following USDA guidelines (USDA, 1989).

Carcasses were cut out by professional butchers, following normal butchering procedures according to the regulation 792-82 of the Venezuelan Commission for Industrial Standards (COVENIN, 1982b). External fat of each cut was standardized to 0.64-cm thickness. Each cut was weighed individually to determine retail product yield and were grouped into three categories as follow: *High-value cuts (boneless)*: *Psoas*, *Longissimus dorsi*, *Serratus and Trapezius*, *Vastus intermedius*, *lateralis* and *medialis*, *Gluteus medius*, *and superficial*, *Semimembranosus*, *Adductor*, *rectus femoris*, *Semitendinosus*, *Tensor fascia* and *Gastronemius*. *Medium-value cuts (boneless)*: *Supraspinatus*, *Deltoideus*, *Subscapularis*, *Triceps brachii*, *Lattisimus dorsi*, *Dorsal trapecius*, *Rhomboideus*, *Obliquus abdominis*, *Cutaneous*, *Rectus* and *Transverse abdominus*. *Low-value (bone-in) cuts* included: *Extensor carpi radialis*, *Rectus abdominis, Thoracic transversus*, *Serratus dorsalis* and *pectoralis*, *Transversus abdominis* and

Table 1
Chemical composition of forage* offered to grazing bulls during the fattening phase*

Variables	Composition, %
Dry matter	94.2
Crude protein	6.6
Neutral detergent fiber	77.9
Acid detergent fiber	43.2
Lignin	6.5
Ash	9.7
Calcium	0.28
Phosphorus	0.23

A composite sample comprised of 22 subsamples taken during the dry season.
* Indicate the number of samples used for analysis of composition of forage.